

# Pipe Repair Strategies on I-29

Research Advisory Committee 2012

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# Pipe Location

- In the Fargo District
- Along Interstate 29 RP 75, North Bound

# Pipe Description

- Double Arch Pipe
- Dimensions - 88" x 54" x 88'



# Pre-existing Conditions



- Voids in shoulder



- Voids in passing lane



# Pre-existing Conditions



- Shoulder settlement
- Void had been filled with gravel

# Pipe Survey



- Separated Joints



- Deteriorated concrete at pipe joint



# Bad Pipe Section

- Top of section



- Bottom of section



# Proposed Repairs

- Cretex, Inc.
  - Perform “Dry Pack Method”
  - Provide internal ties
  
- Subsurface, Inc.
  - Reestablish and Seal Joints
  - Fill voids around the pipes
  - Tie Joints with internal ties
  
- QuakeWrap, Inc.
  - Provide “Wet Layup” material
  - Have a rep present to insure proper installation

# Cretext, Inc. Repairs

- Cretext, Inc.
  - Performed “Dry Pack” Method
  - Patched deteriorated floor in pipe with PCC



# Cretex Inc. “Dry Pack” Repair

## Dry Pack Mix Design

- 8 bag mix
- 6.5% Air Content
- 0.30 – Water Cement Ratio
- 38 oz/yd Plasticizer
- 0.5 lb./yd – Macro Fiber
- Total Unit Weight 146.42 lbs/ft<sup>3</sup>



# Concrete floor Repair

- Tied mesh to existing rebar
- Concrete floor after repairing with PCC



# Subsurface Inc. Repairs

- Reestablished joints with concrete mortar as needed.
- Placed flexible foam saturated oakum rope in joints
- Injected flexible foam behind joints
- Injected Rigid Foam behind pipe
- Placed surface epoxy on some joints.



# Joint Repair

- Reestablish Joints with a concrete repair mortar





# Sealing Joints with Flexible Foam

- Placed flexible foam saturated oakum rope in joint and allowed to expand



- Injected flexible foam near bell and spigot to form a complete collar

# Void Filling

- Injected Rigid Foam behind RCP





# Placing Surface Epoxy



# Internal Ties

Internal ties



Internal tie Installed





# QuakeWrap, Inc. Repairs

- Wet layup with Carbon Fiber Fabric
- Wet layup with Fiberglass Fabric
- Provided Subsurface with supervision and training for the installation of material

# QuakeWrap Inc. Repair

- Saturate Wrap with resin and place on PVC Pipe



# QuakeWrap Inc. Repair

- Placed tack coat on the top of the pipe joint



# QuakeWrap Inc. Repair

- Placed 2 layers of resin saturated Carbon Fiber wrap



- Placed 2 layers of resin saturated Fiberglass wrap



# Summary of Repair Methods

- “Dry Pack Method”
- Concrete floor repair
- Reestablish joints with concrete mortar
- Seal joints with oakum soaked flexible foam and injection
- QuakeWrap joints
- Fill voids with rigid foam
- Tie pipe sections

## ■ Cost

- “Dry Pack Method” and concrete floor repair = \$0.00
- Reestablishing Misc. joints, sealing joints with flexible foam, filling voids with rigid foam (50k), setting internal ties and installing QuakeWrap = \$93,520
- QuakeWrap Material = \$18,900

## ■ Project Duration

- 10 days (4 of 10 no work because of rain)

# Pipe and Embankment Excavation

- Twin arch pipes were removed as part of an I-29 project in June of 2011
- M & R, the Fargo District, and Design worked together to incorporate a plan note that Allowed M & R to observe and document the excavation of the pipes

# “Dry Pack Method”

2009 after repair



2011 before excavation





# Concrete Floor Repair

**2009 after repair**



**2011 before excavation**



# Reestablish Joint

2009 during repair



2011 before excavation

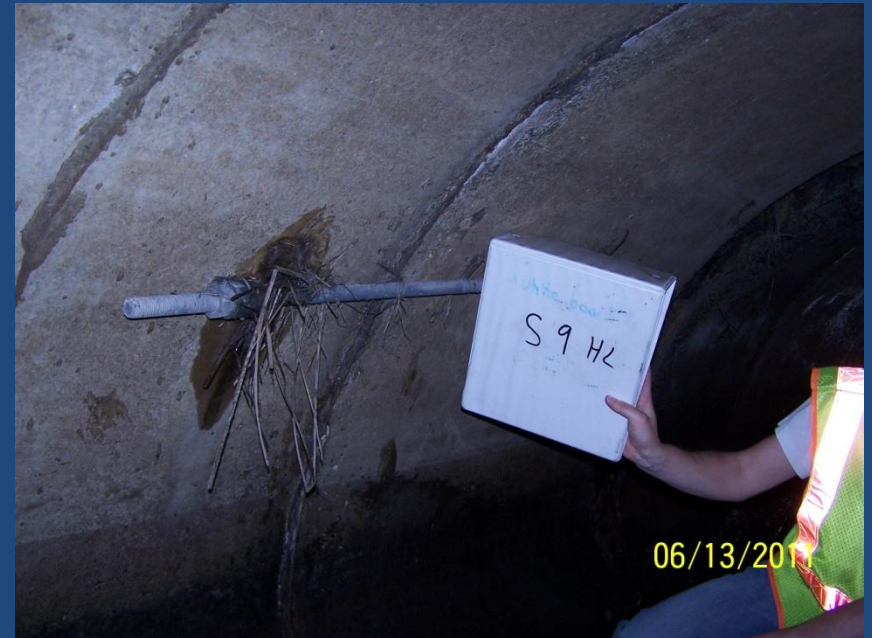


# Joint Sealing

**2009 after repair**



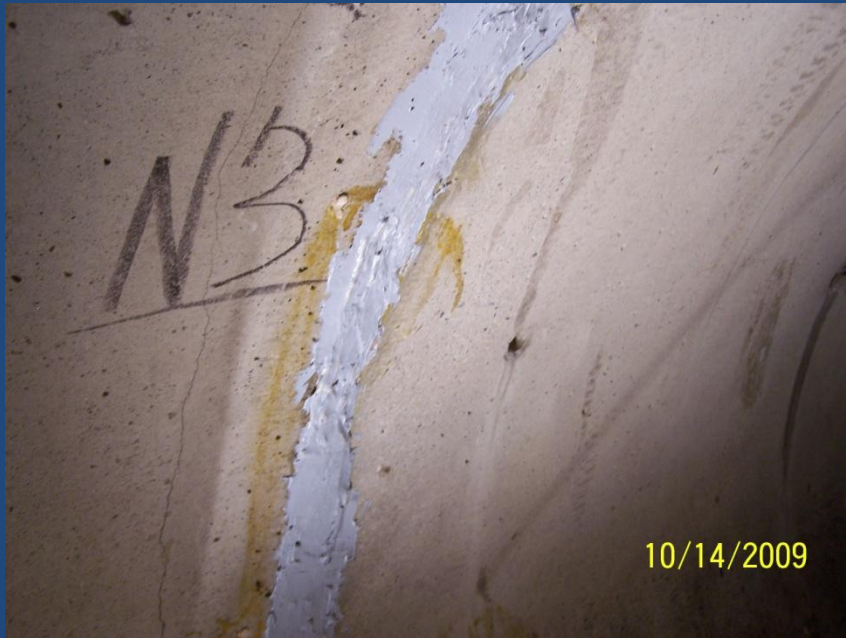
**2011 before excavation**





# Surface Epoxy

2009 after repair



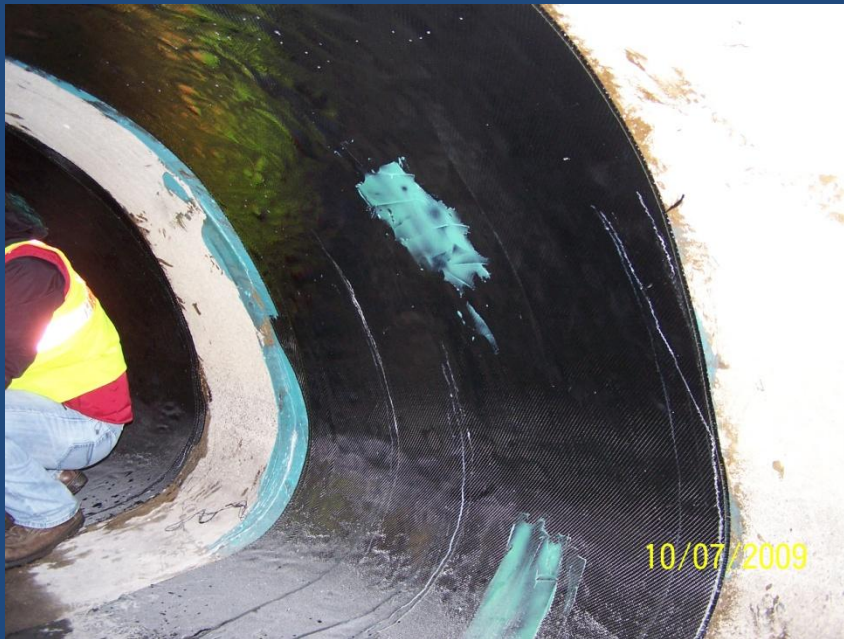
2011 before excavation





# Carbon Fiber QuakeWrap

2009 after repair



2011 before excavation



# Fiberglass QuakeWrap

2009 after repair



2011 before excavation





# 2011 excavation work zone

Concrete slabs cut for removal



Removal of slabs



Chunk of foam on  
bottom of concrete

# Voids beneath pavement

#1 some structural foam



# 2 no structural foam





# Voids under pavement

**#3  $\frac{3}{4}$  full of structural foam**



**#4 no structural foam in void**



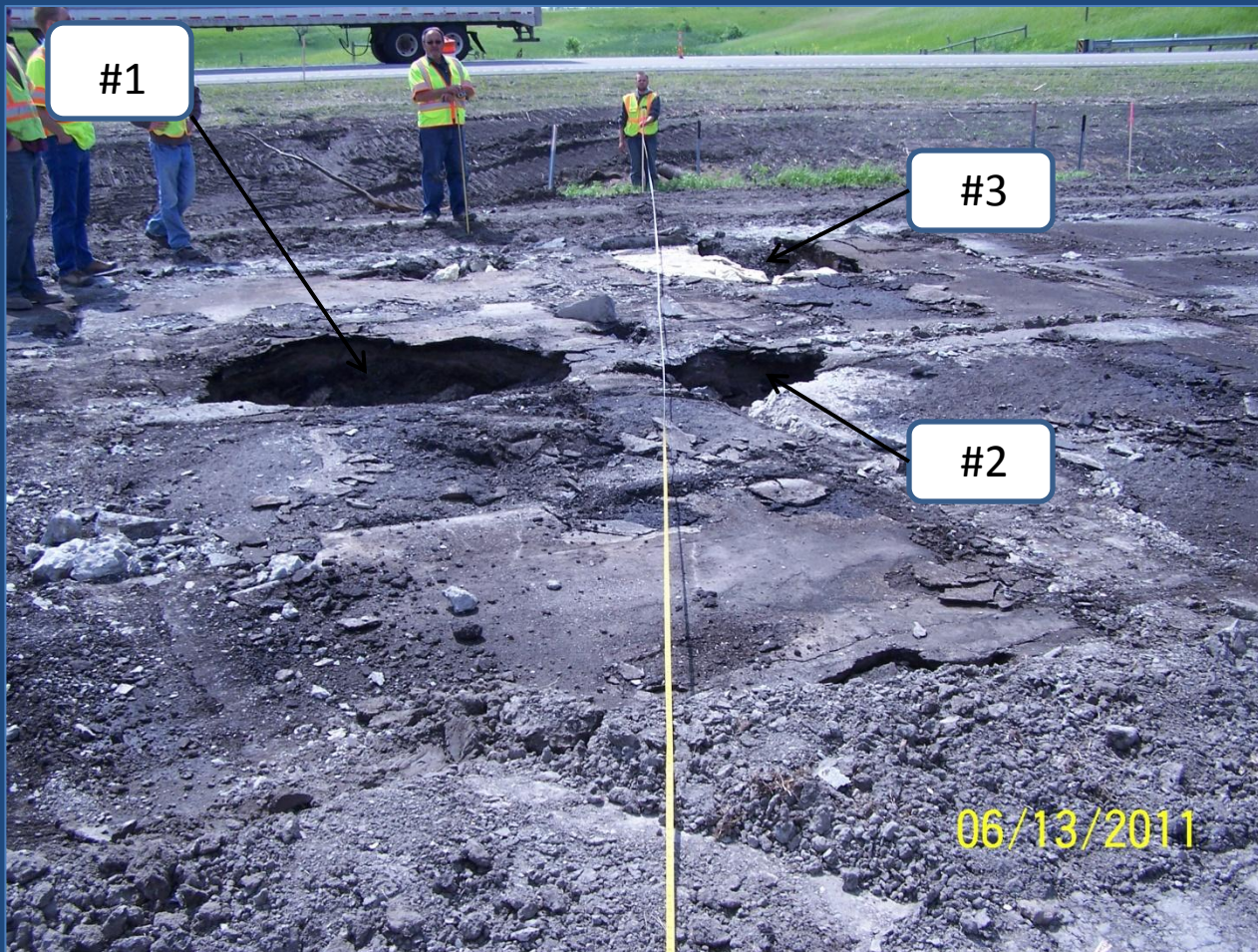
# Void under pavement

**#5 no structural foam in void**





# South Pipe Voids





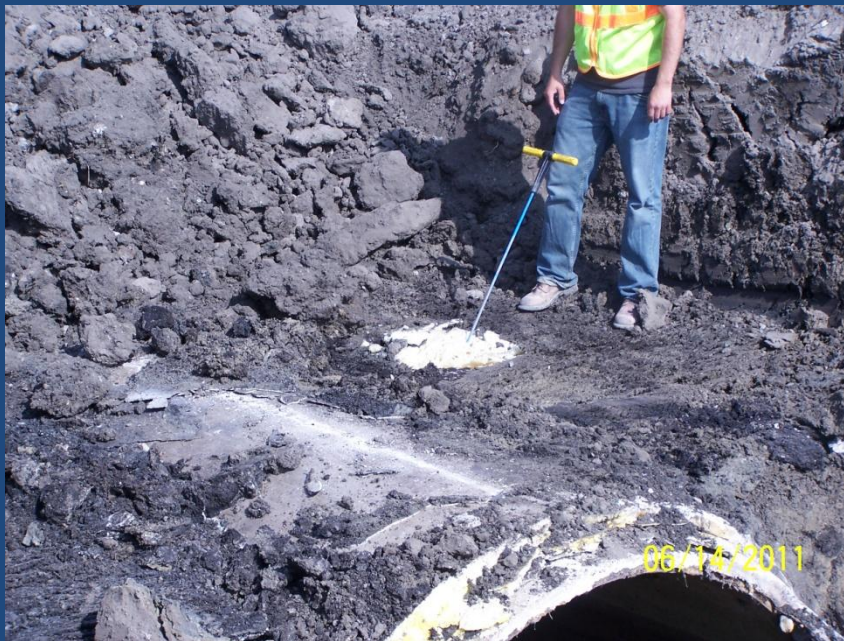
# North Pipe Voids





# Embankment Foam

Structural foam near pipe



Structural foam around haunch



## Flexible foam around pipe joint



## QuakeWrap removal



# Conclusions

- All joints remained sealed
- Minimal deterioration of mortar patches
- Epoxy did not adhere well to concrete in some areas
- No signs of pipe movement
- Hard to address all embankment voids during repair

# Lessons Learned

- Flexible foam soaked oakum with injection worked well but a surface epoxy is recommended for longevity.
- Rigid foam did not fill some voids under the pavement.
- QuakeWrap application requires the joint to be aligned and sealed before installation and is labor intensive.
- Internal pipe ties were effective to prevent movement.



# The End

## Questions?

